

The shortest proof that Eulers-Mascheroni's constant is Transcendental

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This is the shortest proof.

First, we must assume that this constant is algebraic, meaning this formula is too:

$$\gamma = \lim_{n \rightarrow \infty} \left(\sum_{k=1}^n \frac{1}{k} - \ln n \right)$$

If this constant is algebraic then this formula can be held true because $\frac{\gamma + \frac{1}{k}}{n}$ would first have to be algebraic:

$$\frac{\gamma + \frac{1}{k}}{n} \sqrt[n]{n} - 10 = 0$$

If γ is algebraic then $\frac{n}{k}$ would have to be too. Holding this formula true:

$$k \frac{n}{k} - n = 0$$

But this equation is not equal to zero:

$$1 + 2 + 3 \dots k \left(\frac{n \rightarrow \infty}{1+2+3 \dots k} \right) - n \rightarrow \infty = \infty$$

Since $\frac{n}{k}$ is not equal to zero then $\frac{n}{k}$ is not algebraic thus Euler-Mascheroni's constant is Transcendental.